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RESEARCH MATERIALS ON THE BIOLOGY OF THE HARP SEAL ON DRIFT ICE IN THE WHITE SEA IN 1966 AND 1967

by

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The expanding trade in marine mammals has led to a /63*
considerable reduction in the stocks of those species that are most valuable from the commercial point of view. There is now an urgent need to document these species and to seek out more sensible ways of exploiting them commercially and of preserving their stocks. This is certainly the case in regard to the White Sea population of the harp seal, which has been the object of intensive exploitation by Russian and Norwegian hunters over a very lengthy period of time.

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*Translator's note: Numbers in the right-hand margin refer to the corresponding page in the Russian text.

The numbers of the White Sea harp seal were determined for the first time in a practical way by Soviet studies in 1927-1928 that employed aerial photography [1]. In subsequent years, this method of recording numbers was improved and it was employed a number of times [6, 8, 9], making it possible to estimate the size of the population and to plan the measures that were required to maintain its numbers.

Considerable attention was also devoted to the harp seal's rate of reproduction for the purpose of determining its rate of replacement [10, 11]. In recent years these studies have been conducted on the basis of (a) a reliable diagnosis of the age of the animals and of (b) the yellow body count and its traces in the ovaries.

Data on the size of the population and on its sex and age composition, and on the reproduction rates of the animals made it possible to determine the optimum standards for commercial exploitation.

The method of aerial photography makes it possible to determine with great accuracy the number of animals that are present on the ice. When this method is used, however, the question arises as to how completely the individuals of the given population are represented at the moment when they are photographed. Observations show that during the period of moult the animals do not remain in the water for a long /64
time when the weather is good. The animals are more sensitive when there is rain or a sharp wind and in case of danger they hasten to hide in the water. Since photography is only possible in good weather, there is every reason to believe that the entire moulting population of animals (at one or more breeding grounds) can be counted completely.

In order to determine the size of the harp seal population, however, it is not sufficient to photograph only the moulting grounds,

because we know that only a small percentage of the total number of sexually mature females who are raising young will be accounted for at the moulting grounds. Consequently, it is necessary to photograph the whelping patches as well. Furthermore, an estimation of sexually mature females makes it possible to estimate the annual number of offspring. It is considerably more difficult to photograph whelping patches than it is to photograph moulting groups, since the density of occurrence of the females is much less and they are spread over larger areas of the ice. The photographing must be carried out within narrow time slots--in the period of most intensive whelping and immediately afterwards, approximately from March 1 to March 4 or 5 (during which time the females remain longer with their pups and enter the water less frequently). Nevertheless, since some portion of these animals might be in the water when the photographs are taken, a more accurate determination of their numbers requires a correction coefficient, that is, it requires that the percentage of females in the water be computed with due consideration given (a) to the age of the pups being reared, (b) to the air temperature, (c) to the amount of precipitation, and (d) to the condition of the ice. In order to establish this coefficient, it is necessary to make a detailed study of female behaviour under conditions that are as close to natural as possible, which can be done only by fixed-base investigations at whelping patches that are not an object of hunting.

Investigations were conducted in 1966 [4, 5] and in 1967. The program of field activities included: the determination of the periods of whelping; observations (a) on the growth and development of pups, (b) on the behaviour of the females at the whelping patches during the

period of lactation, and (c) on the course of how moult; a study of harp seal estrus; tagging; and a study of the natural mortality of the pups:

The operational methodology consisted of the following: during observations on the behaviour of the females at whelping patches, we established (a) the number of females that were on the ice and (b) the /65
number that were in the water at counting time. For this purpose we made a circumvention of the whelping patch and took a count of the number of pups and the number of adult females on the ice.

The periods of whelping were determined by direct observations and by conducting aerial reconnaissance.

The rates of pup growth and pup development were studied by means of regular weigh-ins and by periodic measurement. The pups were originally weighed on scales for children (like those that are used by doctors) and later on full-sized [regular] scales.

The feeding regime for pups was established by conducting stationary [fixed] observations on a group of animals over the course of an entire day. Sample post-mortems were performed to determine the amount of milk consumed at a single feeding.

Moulting was studied by periodically observing a large group of pups - moreover, pups whose exact times of birth were known were under observation.

The pups were tagged with round, plastic tags, red, 35 mm in diameter, with a number and with the mark "6 BNIPO". The tag was attached through two openings in the tail by a monometallic thread.

Hydrometeorological Conditions in the Operational Area of the Drift Camp in 1966

Heavy frosts that began as early as December 1965 caused rapid ice formation on the White Sea and by the time the ice camp had been set up on March 2, the entire aquatorium of the White Sea was covered with scale 8-10 ice of considerable thickness. It became frosty during March, but the weather was generally clear and thus permitted research activities to be carried out. Meteorological conditions were recorded at 0800, 1200, and 2000 hours and they are presented in Table 1.

It can be seen from this table that the weather deteriorated considerably from March 6 to March 9 and this complicated operations, interferring with the investigation of changes in female behaviour.

The ice conditions at the time when the whelping patches formed were exceedingly difficult. This interferred to some extent with the passage of the seals through Gorlo into the White Sea Basin. This was the reason that aerial reconnaissance on February 24 failed to show any /68 concentrations of adult animals in the basin. It was only on February 26 that the first (not very heavily populated) breeding grounds were found in the vicinity of Sosnovka settlement, at a point 20 km east of Cape Nikodimskii, and at a point 25 km south of the settlement of Strel'na. None of the areas in which the animals were found, save for the grounds south of Strel'na, were characteristic of whelping patches. It was only on March 1 that a whelping patch was found with 25,000-30,000 females, 35 km south of Tetrino.

TABLE 1 /66

Meteorological Conditions in the Area of the Ice Camp, March 1966

Date	Air temp., below 0	Wind direction and wind force, m/sec	Visibility in km and other weather conditions
3	15	West, 2	Cloudy with clear patches.
	14	West, 3	Visibility, 15 km.
	15	Calm	
4	17	Northwest, 6	Clear; drifting snow.
	10	Northwest, 10	Visibility, 10-15 km.
	10	Northwest, 5	
5	12	West, 3	Clear. Visibility, 15 km.
	10	Southwest, 2	
	17	Calm	
6	17	South, 2	Fog.
	10	South-southwest, 4	
	7	South-southwest, 6	
7	13	Southeast, 2	Snow. Visibility, 2 km.
	12	Northeast, 7	Snowstorm. Visibility, 1 km.
	16	Northeast, 8	Snow. Visibility, 4 km.
8	13	Northeast, 4	Clear; drifting snow. Visibility,
	12	Northeast, 6	10 km.
	16	Northeast, 4	
9	19	Northeast, 6	Clear. Visibility, 10 km.
	16	East, 7	
	20	Northeast, 7	
11	18	North, 3	Clear. Visibility, 15 km.
	12	Northwest, 2	
	17	Northwest, 3	
12	14	Northeast, 2	Clear. Visibility, 10 km.
	9	Northeast, 2	
	17	Northeast, 3	
13	14	Northeast, 3	Clear. Visibility, 10 km.
	9	Northeast, 2	
	16	Northeast, 3	
14	15	Northeast, 1	Clear. Visibility, 10 km.
	13	Northeast, 2	
	16	Northeast, 4	
15	13	Northeast, 10	Snowstorm. Visibility, 1 km. /67
	10	Northeast, 7	Snowstorm. Visibility, 1 km.
	14	Northeast, 2	Clear. Visibility, 10 km.

17	16	Calm	
	12	West, 2	Clear. Visibility, 10 km.
	19	West, 2	
18	17	North-northwest, 2	Clear. Visibility, 10 km.
	10	Southwest, 2	Cloudy. Visibility, 2 km.
	18	North-northwest, 4	Clear. Visibility, 6 km.
19	15	Southwest, 3	Clear. Visibility, 8-10 km.
	9	Southwest, 1	
	19	Southwest, 1	
20	15	Southeast, 5	Clear. Visibility, 7-8 km.
	10	Southeast, 10	Snowstorm.
	6	Southeast, 6	Snowstorm.
21	8	Northeast, 5	Snowstorm.
	6	Northeast, 5	
	9	Northeast, 5	
22	11	Northeast, 8	Snowstorm.
	10	Northeast, 9	
	14	Northeast, 7	
23	14	Northeast, 9	Drifting snow, gusting snow.
	11	Northeast, 5	
	15	Northeast, 4	
24	16	Northeast, 5	Clear. Visibility, 10-15 km.
	12	Northeast, 6	
	17	Northeast, 5	
25	16	Northeast, 5	Clear. Visibility, 6 km.
	15	Northeast, 7	Snowstorm.
	18	Northeast, 10	Blizzard.

Periods of Pup Birth, Growth, and Development

The females of the White Sea population of the harp seal arrive for whelping each year at the exact same regions of the White Sea aquatorium, which are bounded by coordinates 65°25'-65°56' north and 38°30'-39°40' east.

Observations conducted over a period of years have shown that females usually give birth between February 28 and March 3.

Newborn harp seal pups are very large, something that is true of all pinnipeds. Their linear length L_c at birth varies between 74 and 105 cm, with an average length of 90.3 cm.

The pups lead a very immobile way of life, spending most of their time in a somnolent state. Only when it becomes hungry does the pup begin to cry out loudly and to crawl in search of his mother. The mother appears from the water at the pup's call and begins to suckle it, lying on her side. The pups arrive at the teats in turns and suck for about 10-20 minutes. Then the pups either crawl off to some shelter or else they remain on the spot and again fall into a sleep.

Suckling occurs more or less regularly over definite intervals of time: the first period at 0600-0700 hours; the second period at 1000-1200; the third period at 1600-1800; and the fourth period at 2100-2300 hours.

There is no doubt that suckling also occurs between 2300 hours and 0600 hours; a chorus of cries from the pups could be heard during the night, which would then cease after a short time.

During the first days, the pups feed every 3-3½ hours, and a /69
single intake of milk during one complete feeding (when the pup ceases to suck of its own volition) amounts of 750 ml. Under such conditions,

the pups probably feed not less than six times per day, consuming 4200-4500 ml of milk during that time, the milk being 42% fat and up to 12% protein [12]. Such feeding permits a very rapid accumulation of subcutaneous fat since their life style is sedantary and since energy expenditures are solely for the purpose of maintaining the internal vital processes, for thermoregulation, and for organic transfers.

The feeding of the pups changes when the growth regime begins; the intervals between feedings lengthen to 4-5 hours and the portions of single intakes of milk increase to 1175 ml. Obtaining food approximately five times a day, the pups probably consume up to 5870 ml of milk per day during this period (Table 2).

The harp seal continues to be suckled on milk for three weeks, after which the females leave the pups and depart from the whelping patches. The offspring accept his indifferently. The older they become, the fewer the cries that are heard at the whelping patch.

Given such abundant feeding, it is no wonder that the daily weight increment of the pups is very great. We had already noticed this in 1965, when there were observations at fixed sites on their growth rate (Table 3).

Similar data were also obtained from weighing the pups in camp in 1966 (Table 4).

The data presented in these tables show the increase in the weight of offspring in the age interval from sprout* to whitecoat with sparse fur varies on average from 1.4 to 2.3 kg per day. At these

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*Translator's note: The Russian term zelenets is used for harp seal pups from birth to the age of three days and suggests "greens" or "youngs sprouts." The term is obviously used because of the coloring of the fur at this time. I have translated it by "sprout."

TABLE 2

Milk Consumption By Pups During Complete Feedings, ml

Age category	Ranges	Average value
Sprouts	650-750	700
Whitecoats	1150-1200	1175
Xhokhlushi	675-1150	912

TABLE 3

Weight Change In the Pups, March 1965, kg

No. & sex of sprouts	Date 14	15	Weight increment	Date 16	Weight increment
251 ♂	12.07	14.23	2.16	16.55	2.32
252 ♀	11.88	13.35	1.49	-	-
253 ♂	10.71	12.54	1.83	13.97	1.43
254 ♂	12.80	14.47	1.70	16.20	1.73

TABLE 4

Weight Change In the Pups, March 1966, kg

Date	Pup number and sex							
	486 ♀	17 ♂	7 ♂	384 ♂	422 ♀	543 ♀	161 ♀	152 ♀
3						11.2	9.4	11.7
4						13.1	11.0	13.1
5						13.1	12.2	13.1
6	9.9	8.7	12.1	17.8	14.8	15.8	14.7	16.7
7	10.8	9.8	15.0	21.0	16.4	16.8	-	-
8	12.3	10.2	18.7	24.0	18.6	19.0	18.5	-
9	13.8	11.4	16.3	25.2	19.2	21.5	21.5	-
11	18.4	13.6	20.8	29.0	22.0	27.0	24.5	-
12	20.7	15.5	-	32.0	24.0	-	-	-
13	-	17.0	-	35.0	24.0	-	-	-
14	-	19.3	-	27.0	26.0	-	-	-
15	-	23.0	-	-	-	-	-	-
19	-	30.0	-	42.0	-	-	-	-
Ave. daily increment	1.8	1.5	1.5	1.7	1.4	1.9	1.6	1.6

rates, the weight of offspring almost triples in two weeks, primarily due to the accumulation of subcutaneous fat, since the linear /71
measurements of the offspring increase considerably more slowly (Table 5).

Table 4 presents the changes in the weight of pups during early growth. Table 6 present weighings of pups that had been captured for observation after they had reached weights of more than 14 kg.

In this pup age-category, the accumulation of subcutaneous fat /72
proceeds more rapidly, but when suckling ceases, a decrease in weight commences. But this tendency is more noticeable in the other group of animals, which were weighed at later [age] periods (Table 7).

Consequently, after suckling has ceased, the weight of the pups that are continuing to moult diminishes by an average of 0.6-0.7 kg per day. At such rates of loss, the accumulated reserves completely suffice for the pup until he begins independent feeding.

We were also able to observe a weight loss of another kind, when it produced a lethal result (Table 8).

The data presented in Table 8 show that if suckling is for any reason terminated very early, when the fat has not accumulated /73
sufficiently, then the emaciation of the pups can end in their death. The death of two young (Nos. 306 and 541) was recorded, but there can be no doubt that the emaciation of two others would also have had the same result. We observed carcasses of the "starved" at whelping patches every year [3].

During drift the relative number of dead pups was regularly taken into consideration* along the numerous recognizeable routes

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*Translator's note: In other words, the dead pups were not actually counted, but their number was estimated (considered) evidently relative to the numbers of the live pups actually found.

TABLE 5

Change in the Linear Measurements of Pups, March 1966, cm

Date	Pup number and sex						
	486 ♀	17 ♂	7 ♂	422 ♀	466 ♀	533 ♂	461 ♂
6	84	74	84	86	96	96	99
13	93	79	90	92	101	106	103
Difference	+9	+5	+6	+6	+5	+10	+4
19	–	94	–	–	112	110	–
Difference	–	+20	–	–	+16	+14	–

TABLE 6

Weight Change In the Pups, March 1966, kg

Date	Pup number and sex						
	344 ♂	81 ♂	464 ♂	212 ♀	466 ♀	533 ♂	461 ♂
3	15.8	15.2	14.6	16.1	–	–	–
4	18.2	18.9	15.4	18.4	–	–	–
5	20.1	19.0	19.2	20.1	–	–	–
6	23.0	22.5	20.5	22.8	22.4	22.0	20.8
7	24.5	25.7	22.3	25.5	26.6	24.0	–
8	–	30.5	25.5	28.0	28.0	–	29.5
9	–	31.7	26.0	30.0	32.5	27.0	30.5
10	–	–	–	–	–	–	–
11	–	38.0	31.5	36.0	37.5	37.0	36.0
12	–	–	–	–	41.0	35.0	38.0
13	–	–	–	–	43.5	36.5	38.5
14	–	–	–	–	45.0	39.0	–
15	–	–	–	–	45.0	40.8	–
19	–	–	–	–	41.0	34.0	–
Ave. daily increment	2.1	3.6	2.1	2.4	2.5	2.1	2.5

TABLE 7

Weight Change In the Pups, March 1966, kg

Date	Pup number and sex								
	484 ♀	2 ♀	222 ♀	89 ♂	544 ♂	412 ♂	9 ♀	540 ♂	352 ♂
17	33.5	45.5	36.0	40.0	34.0	52.0	46.0	35.5	29.5
18	32.5	46.0	38.0	40.0	35.0	51.5	47.0	33.5	30.5
19	34.5	45.5	38.0	38.5	34.5	49.0	46.0	34.0	28.5
23	33.0	42.0	34.0	38.0	31.0	48.0	44.5	33.0	27.0
Ave. daily loss	0.4	0.8	0.9	0.4	0.8	0.6	0.5	0.9	0.7

TABLE 8

Lethal Weight Change In the Pups, March 1966, kg

Pup no.	Date 6	7	8	9	10	11	12	13	14	15	16
306	11.1	11.5	10.9	10.3	-	9.2	Died				
219	10.2	11.7	13.0	15.7	-	12.3	12.2	12.0	11.6	11.3	10.5
541	10.3	9.7	9.4	9.0	-	8.2	7.9	7.2	7.0	Died	
379	13.0	14.6	16.7	13.2	-	-	12.0	11.7	11.5		

TABLE 9

Magnitude of Natural Pup Mortality at the Whelping Patch, March 1966

Date	Pups counted Total	Number dead	Percentage dead
3	167	3	1.8
5	217	2	0.9
6	115	1	0.9
7	87	1	1.1
8	56	1	1.8
11	32	1	3.1
14	300	3	1.0
18	75	2	2.7
20	60	2	3.3
Total:	1109	16	1.4

TABLE 10

Female - Pup Ratio at the Whelping Patch, March 1966 (no. of animals)

Date	Hours of observation	Animals counted Pups	Females on ice	Females in water no.	Females in water %	Weather conditions
3	1500-1630	167	139	28	16.7	Cloudy; wind, 3 m/sec.
4	0900-1100	192	69	123	64.0	Drifting snow; wind, 10 m/sec.
4	1530-1800	124	56	68	55.6	Drifting snow; wind, 6 m/sec.
5	0900-1120	167	154	13	7.8	Clear; no wind.
6	1000-1100	115	46	69	60.0	Fog.
7	1000-1100	87	10	77	89.0	Snowstorm.
8	1000-1100	56	28	28	50.0	Drifting snow; wind, 6 m/sec.
9	1200-1300	105	47	58	55.0	Clear; wind, 7 m/sec.
11	1200-1300	135	73	62	46.0	Clear; wind, 2 m/sec.
12	1200-1300	116	38	38	50.0	Clear; wind, 2 m/sec.
13	1200-1300	107	58	49	46.0	Clear; wind, 2 m/sec.
14	1200-1300	113	60	53	47.0	Clear; wind, 2 m/sec.

around the whelping patch in order to determine mortality of the pups during nursing and moult (Table 9).

There is a possibility that the magnitude of natural mortality /74
(1.4%) that we found was somewhat understated, since a portion of the carcasses could have been covered with snow or buried under fragments of the hummocked ice.

The causes of natural pup mortality can be diverse, but the greatest percentage is due to stillbirths and to death from exhaustion.

The Behaviour of Females at Whelping Patches

While the pups are being nursed, [the behaviour of the females] is determined by a number of factors, of which the predominant one is maternal instinct, which appears with particular intensity in the first days after whelping. It is true that the pups do not require any special care, since they are completely adjusted from the first hours of life to the raw conditions that exist on drifting ice, and the concerns of their mothers are chiefly reduced to feeding the young on time and in sufficient quantity, which they do with great precision, as can be seen from the information that has been presented.

In order to suckle, the female comes out onto the ice and searches out the pup by smell (she sniffs the other whitecoats and sometimes crawls along the trail left in the snow by her offspring). After suckling, the females do not rush to enter the water; in good weather they will lie in the vicinity of their pups for a long time -- in the first days they scarcely leave them at all. As time passes, the females begin to absent themselves more frequently and for longer periods of time, until they finally abandon the young.

The sojourn of the females at the whelping patches is taken advantage of in order to determine their numbers by aerial photography. Naturally, it is better to make this calculation during the first days after whelping, when a powerful maternal instinct constrains the females to the company of their pups. But since it is in any event possible for some females to be in the water at the moment the photographs are taken, then some portion of the adult females will be in the water and they will not be counted. As a result, the number of females provided by aerial-photographic documentation will turn out to be less than the actual number. In order to avoid or to minimize this error, it is desirable to determine a coefficient of error to be used in calculating the number of females and pups during field operations on the ground. The approximate number of adult animals was determined in the following manner (Table 10).

The percentage of females that is in the water at the moment the calculation is made depends above all on weather conditions: the better the weather, the greater the number of females that will be on the ice, and vice versa. Thus, when the weather was very good on March 5, only 7.8% of the females were in the water, while 89% of the females were in the water during the stormsnow on March 7.

The weakening of the maternal instinct with the passage of time /75
also results in an increase in the percentage of females to be found in the water at any given time. Consequently, the calculation of females at whelping patches by means of aerial photography may be conducted only in the first days following peak whelping and in clear weather either without wind or with very little wind.

Aerial photography of the whelping patches proved possible on March 3 and March 5 (Tables 1 and 10), when there was 83.3% and 92.2% of the female cows on the ice, respectively.

In our opinion, the fright taken by the animals also affected /76 the results of the count of females found on the ice. This is noticeable in the results of the count of females on different aerial surveying routes (Table 11): routes #1 and #2 were plotted at sectors that had never been visited, as opposed to route #3, a permanent [fixed observation point]. The results of the count in the two different cases differ from each other. The circumstances can be explained by the reaction of the animals to the presence of humans at the whelping patch. Direct observations also confirm this. At sections of the whelping patch where we had performed various activities, there were fewer females present — all other conditions being equal -- than at sectors where we had never been at all or visited only very briefly.

Consequently, under the best conditions the average number of females that could possibly be in the water at the time of photographing would be approximately 12.0%. This correction coefficient may be decreased or increased somewhat with changes in the weather, but under conditions like those prevailing on March 3 and March 5 the deviation in one direction or the other could not be more than 4-5%. In other words, given all the information available, we could apply a correction coefficient of 12.0%±4.5% when calculating the numbers of sexually-mature female seals based on the data obtained by aerial photography on March 3 and March 5, 1966.

TABLE 11

Female - Pup Ratio on Different Routes, March 1966 (no. of animals)

Date and hours of observation	Routes 1			2			3		
	Pups	Females no.	%	Pups	Females no.	%	Pups	Females no.	%
3, 1400-1700	62	53	85.5	50	46	92.0	55	40	72.7
4 1000-1200	32	22	68.7	50	14	28.0	65	21	32.3
4 1600-1800	38	20	52.6	26	17	65.4	60	19	31.6
5 1000-1200	83	78	93.9	84	76	90.5	-	-	-

TABLE 12

White Sea Harp Seal: Dynamics of Moult, March 1966

Date	Total number examined	Of which (in percent): Sprouts	Whitecoats	Moulted and intensely moulting khokhlushi A and B	Juveniles
13	46	-	2.2	93.5 and 4.3	-
14	300	0.3	1.3	98.1	0.3
18	212	-	-	63.7 and 35.8	0.5
23	607	-	-	- 93.5	6.5

The whelping patch leads its normal, measured life until March 10, then a period of estrus sets in, which leaves a special mark on the behaviour of the females. They are still lactating, but they are now spending more and more time in the company of the bulls, who appear at the whelping patches and follow the females. Estrus is accompanied by tremendous excitement in the animals and by fierce fights among the bulls. Thus, almost all of the bulls encountered were covered with bleeding wounds.

Differing opinions were maintained until very recently regarding the mating of the harp seal. Some investigators were of the opinion that coitus could take place only in the water, while others were convinced that it took place only on the ice. Through repeated observations it has been determined that coitus takes place both on the ice and in the water. We may assume that this act more commonly occurs in the water, since mating on the ice has rarely been observed -- when a female is being followed by bulls, she will usually enter the water. Coitus on the ice lasts 20-25 minutes.

In 1966 estrus ended on March 24. The length of gestation of harp seal females, counting from the moment of mating until the birth, lasts 11.5 months. But not even once were we able to find in March-May an implanted ovum in the uterus. Implantation in these animals is definitely delayed until August [7].

The Moult of Pups

Harp seal pups are born covered with a thick and soft wool, light in color with a lemon tinge. It is clear from this coloring why

the newborn pups are called "sprouts". The greenish tinge of the hair fades after 3-5 days and the pelt becomes pure white. It is at about this time that the pups begin to moult. The hair initially comes out with difficulty, but with the passage of time the moult intensifies. The growth of new, dark hair begins seven days after birth. /78

Two weeks after birth the pup becomes a "khokhlusha": the whitecoat hair thins out considerably and new, dark hair begins to be seen. After 18 days, 64% of the young animals have bald spots from moulting hair, and 21 days after birth the majority of the pups (93.5%) have the remnants of white hair only on the back, while some of the pups (6.5%) have already moulted completely.

Special observations (Table 12) give an idea of the course of the moult. Approximately the same picture of moult among pups is given by S.V. Dorofeev [2] and by E. Sivertsen [12].

Investigations at the Ice Camp in 1967

The program for studying the harp seal on drifting ice in 1967 was identical to that of the preceding year. But the operational conditions proved to be much more difficult and this had an effect on the results.

The first observations on the numbers of females at the whelping patch in 1967 were begun on March 4. The high cloud cover with clearings and the very light south-southwest wind created conditions favourable to the animals present on the ice. Under such conditions we decided to investigate the ice around the camp and, along with the relative proportion of numbers of females and young, to

ascertain the outlook for further investigations. Only 55 females and 60 young were counted in four sorties lasting 10 to 13 hours. The /79 females as compared to the young accounted for 91.6%, which is very close to the proportion at the whelping patch on March 5, 1966.

Since there seemed to be so few animals in the vicinity of the camp that they would not provide us with a complete set of observations, the camp was moved to the whelping patch, where teams of hunters were carrying on their work. There could obviously be no question of any kind of natural situation, so that under these conditions too it was impossible to observe the dynamics of female numbers. Only on March 6 was an attempt made to determine the relative numbers of young and females on the ice (Table 13).

Although conditions at the whelping patches were unfavorable for counting females and young, the figures obtained hardly differ from those obtained under identical weather conditions in 1966 (Table 11, March 3 and March 5).

The age composition of the adult females (Table 14) was studied by surveying the whelping patch with binoculars and then dividing the animals into three age groups according to their color. The groups that were identified were: (1) grey-spots (young females); (2) semipatches* (females of intermediate age); and (3) patches* (old females).

These data are interesting in comparison to the same data of the preceding year, when there was intensive hunting of adult females

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*Translator's note: The Russian term krylanovyi suggests the presence of an epaulette, i.e. some sort of wing or drumstick, and clearly refers to the patch (spot) visible on the side of an adult animal.

TABLE 13

Female - Pup Ratio at the Breeding Grounds, March 1967

Group of animals	March 4 number	March 4 percent	March 6 number	March 6 percent	Total number	Total percent
Pups	60	100	60	100	120	100
Females	55	91.6	47	78.3	102	85.0

TABLE 14

Age Composition of Females,
White Sea Herd of the Harp Seal,
1962, 1963, and 1967

Animal age category	1962 number	1962 percent	1963 number	1963 percent	1967 number	1967 percent
Grey-spot	696	77.0	193	69.2	102	20.3
Semipatch	132	14.6	67	24.0	171	33.9
Patch	76	8.4	19	6.8	231	45.8
Total:	904	100.0	279	100.0	504	100.0

at the whelping patches and moulting grounds. At that time, the bulk of the females consisted of grey-spots and semipatch females while the patch females constituted only an insignificant percentage which indicates a very low survival rate by the animals that had been caught and tagged just when they had reached an intermediate age.

Since 1964 the USSR has discontinued the taking of females at whelping patches. This measure, according to the data that has been obtained, has considerably increased the survival rate of these animals. The number of animals in the oldest age group has been increasing for the last four years.

During the investigations on drifting ice, considerable attention was devoted to marking the pups. A sum total of 987 pups was marked in two seasons.

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